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Total No. of Questions : 5

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EC-188

B.E. III Sem. (CGPA) Civil Engineering Exam.-2012-13

MECHANICS OF MATERIAL

Paper : CE-302

Time Allowed : Three Hours

Maximum Marks : 60

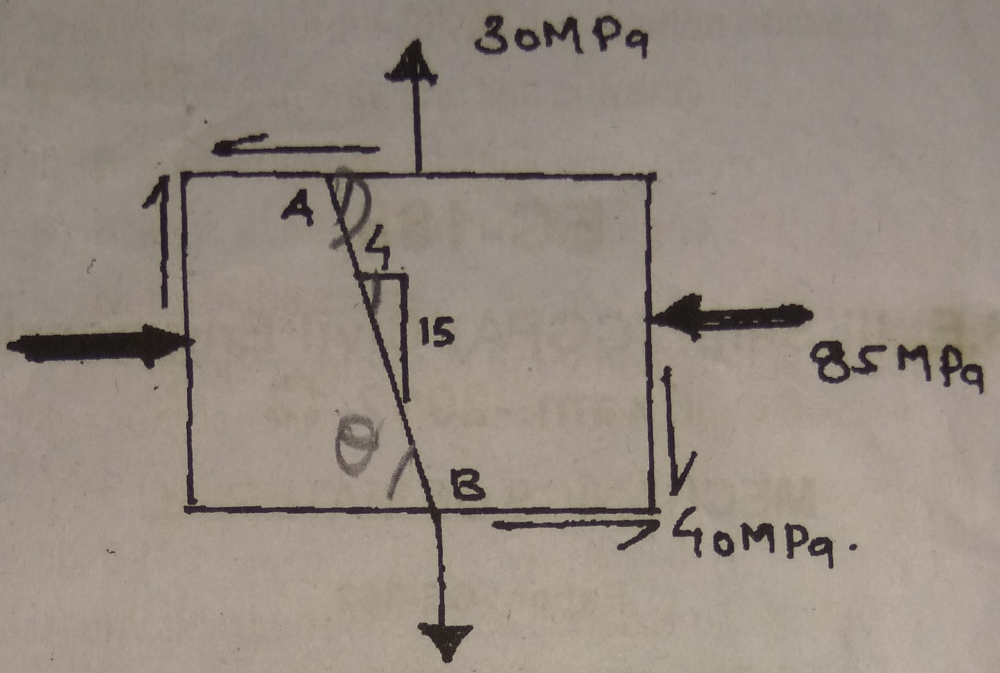
Note : Attempt all questions.

Q.1. Derive the relation between modulus of Elasticity. i.e. Young's Modulus (E), Modulus of Rigidity (G) and Bulk Modulus (K). 12

Or

a) Define Principal stress and Principal plane. 12

b) An element in plane-stress is subjected to stresses on its faces as shown in the fig. Find the normal and shear stress components acting on inclined plane AB. Also find principal stress. Principal planes and Maximum shear stress.



Q.2. a) Derive the relation between Bending moment. Shear force and rate of loading. 4

b) Two 50mm x 150mm rectangular timber section are glued together to form a T-sectron as shown in fig. 1. If sagging bending moment of 4 K.N.m is applied to this beam about the Horizontal axis. 8

i) Find the Maximum Tensile and compression Bending stresses at the remote fibres.

ii) Calculate the total compressive force developed by the normal stress above the neutral axis.

iii) Find the total force due to tensile bending stress.

Or

A symmetrical beam of I-section is 200 mm x 400 mm in size. The thickness of the flange is 20mm and the web is 15mm as shown in fig. 2. The beam carrying udl of 20KN/m over entire length. Draw shear stress distribution over the Depth of the sectron. 12

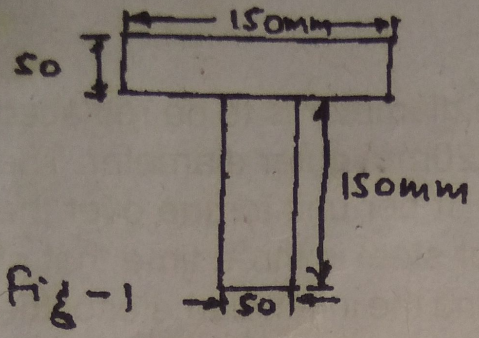


Fig-1

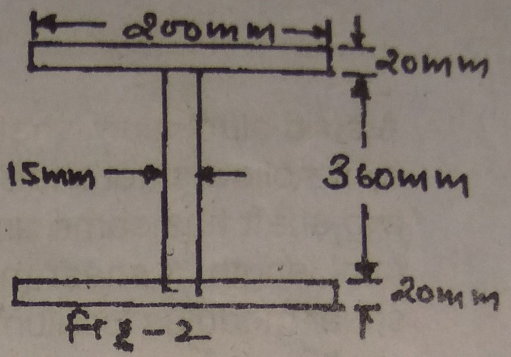


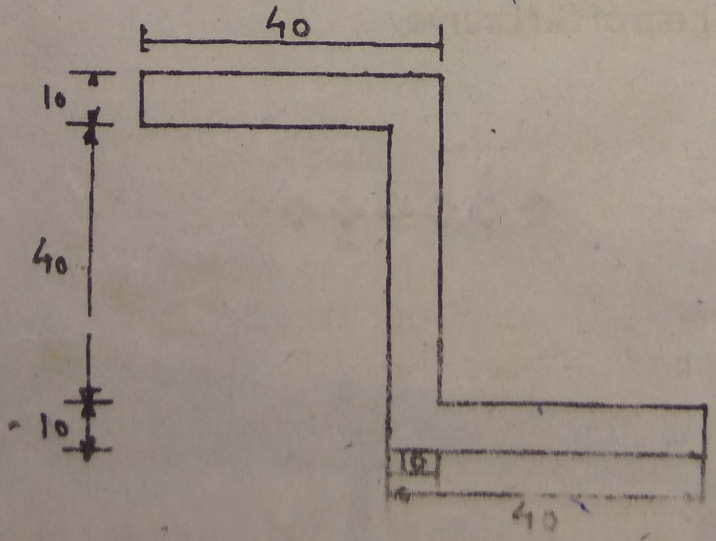
Fig-2

Q.3. Derive from fundamentals the expression for Euler's clipping load for a long column with one end free and on end fixed. 12

Or

Compute the Euler crushing load for a hollow cylindrical cast-iron column of 150mm external diameter and 20mm thick. If it is 6m long and hinged at both ends. $E = 75 \times 10^9$ N/m^2. Compare this load with that given by the Rankine formula using $P_Y = 550 \times 10^6$ N/m^2 and $a = {}^1/_{1600}$. For what length of column would these two formulae give the same crushing load? 12

Q.4. For the z-shape cross section shown in the fig. First determine moment of Inertia Iy, Iz and Izy. Then obtain the directions of the principal axes and principal of Inertia. 12



Or

A solid aluminium shaft 120mm diameter is to be replaced by a hollow steel shaft having 120mm outer diameter. The two shaft has same angle of twist per unit torque over the total length. If shear modulus for steel is three time that of shear modulus for aluminium. Find the inner diameter of the shaft. 12

Q.5. a) Draw stress-strain diagram for Ductile Material and Describe its different features. 6

b) Define the following Mechanical Properties (i) stiffness (ii) Hardness (iii) Toughness. 6

Or

Define the following Material Properties. 12

i) Fatigue

ii) Fatigue strength

iii) Endurance limit

with the help of S-N curve.

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